PATENT SPECIFICATION 725,568

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COMPLETE SPECIFICATION.

Improvements in or relating to Electrical Liquid Heater.

We, RAINBOWS, INC., a Corporation organised under the laws of the State of New York, United States of America, of 806 East 141st Street, Bronx, New York, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to an electric heater adapted for the quick heating of a flowing liquid stream, and is here disclosed in its application to the heating of water for use in a hot coffee vending machine.

The heater of the present invention may be used in connection with any device which requires a supply of hot water in its operation, more particularly wherein the hot water supply must be delivered at or about a predetermined temperature. Examples of such devices are hot coffee vending machines, vending machines for other kinds of hot drinks, dish washers, laundry machines, and the like.

Among the objects of the invention are to provide an electric hot-water heater containing a multiplicity of heating sections through which the water passes in succession, having different effective capacities for heat generation, whereby the device is suited for installation in different parts of the country where the mineral content of the water supply and thus its electrical conductivity, may be widely different.

Another object of the invention is to provide a liquid heating device wherein the length and cross-sectional area of the electrical path through the liquid can be accurately controlled under conditions of quantity manufacture and rapid assembly.

Reference is made to the accompanying drawings, in which ;

Fig. 1 is a fragmentary perspective view of a hot coffee vending machine with portions broken away to show the interior construction thereof. In such a machine, a hot water heater according to this invention may be positioned within the sub-assembly 15 and delivers hot water through hose 64 to the mixing chamber 13.

Fig. 2 is a fragmentary horizontal sectional view on the line 2—2 of Fig. 1 showing the electrical heater 14 of the present invention in plan.

Fig. 3 is a vertical sectional view of one form of electrical heater made according to the present invention, taken on line 3—3 of Fig. 2.

Referring to the drawings, 10 represents the casing of a coffee dispensing machine in which there is disposed a refrigerating unit 11 adapted to contain coffee and cream, a liquid sugar container 12, a mixing chamber 13 connected with a water supply extending from an electrical heater 14 of the present invention and located in sub-assembly 15. Hot coffee is dispensed from a spout 16 into a cup 17 positioned in an opening in a door 18 that covers the front of the apparatus. Connected to the mixing chamber 13 are magnetically operated valves 19, 20 and 21 for controlling the flow of the various ingredients which make up the coffee drink. The magnetic valves 19 and 20 lie within the refrigerating unit as through them must pass cream and liquid coffee that must be kept under refrigeration.

On the sub-assembly 15 is a set of switches 22 in a common casing 23 of conventional construction which is connected to a source of current supply and these switches are electrically connected respectively by wires 24, 25, 26 and 27 to terminal posts 28, 29, 30 and 31 respectively of the electrical heater 14.

The respective terminals are connected respectively with different conductive sleeves 32,

[*Price* 2*s.* 8*d.*]

Price 4s 6d

33, 34 and 35, each constituting a secondary electrode, and located end-to-end. These sleeves, in the form of device shown in Fig. 3, are of the same internal diameter but of different lengths and therefore of different internal surface areas. Positioned within these sleeves is a central drum-shaped member 36, constituting a primary electrode, which is co-axially mounted with the sleeves and has an external diameter smaller than the internal diameter of the sleeves, thus providing an annular space for water to flow between it and the sleeves. The term "drum-shaped" is intended to cover a cylindrical form as well as forms having an outer surface which is circular in shape in a plane at right angles to the axis of the primary electrode but varying in circumference along the length of said electrode. This central member or electrode 36 has annular grooves 37 located adjacent sealed ends of the sleeves, as indicated at 38. The sleeves are sealed and insulated from one another by such seals.

The central electrode 36 has threaded inlet and outlet end portions or projections 41 and 42 adapted to carry insulators 43 and 44 respectively. The insulators 43 and 44 are respectively sealed to the respective end sleeves 32 and 35 by sealing washers 45 and 46 respectively. The sleeves are kept properly spaced relative to the peripheral surface of the electrode 36 by these insulating washers 43 and 44. The washer 43 is held in place on the projection 41 by a metal washer 47 which carries a sealing ring 48 and a securing nut 49. The securing nut 49 has a terminal 51 to which is attached a wire 52 serving to place the electrode 36 in the electrical circuit. The water enters the inlet portion 41 through opening 53 thereof and passes through liquid passageway 72 at right angles to the axis of drum-like electrode 36 into the annular liquid space between the outer surface of drum-like electrode 36 and the inner surface of sleeve electrodes 32 to 35 to establish the electric circuit between the drum-like electrode 36 and the sleeve electrodes 32, 33, 34 and 35. With this circuit established, the water will become quickly heated because of its resistance to current flow.

The insulating washer 44 is held on portion 42 by a washer 55 having a seal 56 and a nut 57 threaded on the portion 42. The outlet portion 42 has an opening 58 communicating with the annular liquid space by means of liquid passageways 73 at right angles to the axis of electrode 36 through which the hot water will be discharged.

Surrounding the sleeve electrodes are a plurality of insulating sleeves 61 carrying respectively the terminal posts 28, 29, 30 and 31. The sleeves tightly receive the sleeve electrodes and the seals 38. The terminal posts 28, 29, 30 and 31 may be tapped into the sleeve electrodes and are locked respectively by lock nuts 62 of the respective screws. A second nut 63 may be provided upon each terminal post to effect the connection of the respective wires 24, 25, 26 and 27 thereto.

The outlet portion 42 of the central electrode may be connected by a hose 64 with the mixing member 13. Water is led to the inlet portion 41 of the electrode 36 by a pipe 65 leading from a water supply. On the sub-assembly is a gauge 66 from which the pressure of the water can be determined. A regulating valve element 67 can control the rate of water flow. The heater can be supported by straps 68 and 69 fixed to the sub-assembly 15.

When making an adjustment for the proper current to be supplied to the heater, to heat the water to the desired degree of temperature an ammeter 71 is provided. The meter reading is taken as the different switches 22 are thrown on and off. When the meter shows that the proper current is flowing, the heater will have been properly adjusted for the given water condition. Any combination of the switches 22 can be used, if, by the use of one sleeve electrode alone, the desired amperage flow is not provided.

As a specific example of a hot-water heater which has successfully handled a wide variety of water conditions encountered in communities in the northeastern section of the United States, for use in a hot coffee vending machine, the following particulars are given: At a water pressure of about 6 lb. per sq. in., and a starting temperature of about 70° F., the heater is designed to handle a flow of about one ounce of water per second and to raise the water to a temperature of 180° F. during a time of passage of about one second. The electrical supply is assumed to be at about 110 or 115 volts. At this voltage, and in order to raise one ounce of water per second from a temperature of about 70° F. to about 180° F., it has been found that about ten amperes of current must pass through the water, whatever may be its condition or conductivity.

If the water is "hard"—i.e., has a high content of ions in solution, the water will be more conductive, and consequently too much current will flow and the water will be heated to too high a temperature. Under such conditions as these, it is necessary to increase the length of the electrical path through the water, or to make the electrode area smaller, or some combination of the two.

What we claim is:—

1. An electric liquid heater comprising a solid primary electrode whose outer surface in a plane at right angles to its axis is circular in shape, a metallic tubular extension of less diameter than said electrode projecting at each end thereof and co-axial therewith, said tubular extensions being adapted to serve as

the supports for said electrode and also to conduct liquid to and from the heater, a secondary electrode surrounding and co-axial with the primary electrode and having an inner surface which in the plane aforesaid is circular in shape and greater in diameter than the diameter of the circular outer surface of the primary electrode, two members of insulating material each having an opening therein adapted to engage one of said tubular extensions and each engaging an opposite end of the secondary electrode and thus supporting said electrodes in nested and co-axial relation in such manner that the two electrodes define an annular liquid space between the outer surface of the primary electrode and the inner surface of the secondary electrode, liquid passageways at right angles to the axis of said electrodes interconnecting the interiors of said tubular extensions, respectively, with opposite ends of said annular space whereby liquid entering at one end of said tubular extensions is caused to flow in said annular space in a direction generally lengthwise of the common axis of said electrodes and thence out the other of said tubular extensions, and means to conduct electric current to said electrodes while liquid flows between them.

2. An electric liquid heater, according to Claim 1, wherein the secondary electrode is divided into segments insulated from each other and adapted to be separately energized in parallel across the current source.

3. An electric liquid heater according to Claim 2, in which at least two of the segments of the secondary electrode are of different internal surface area.

4. An electric liquid heater according to Claim 2 or 3, in which at least two of the segments of the secondary electrode are of different length.

5. An electric liquid heater according to any one of Claims 2 to 4, in which the primary electrode is cylindrical and is divided into cylindrical segments electrically connected together, each cylindrical segment forming with a secondary electrode segment an annular fluid space.

6. An electric liquid heater according to Claim 5, in which at least two of the cylindrical segments are of different external surface area.

7. An electric liquid heater substantially as hereinbefore described and as illustrated in the accompanying drawings.

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725,568 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

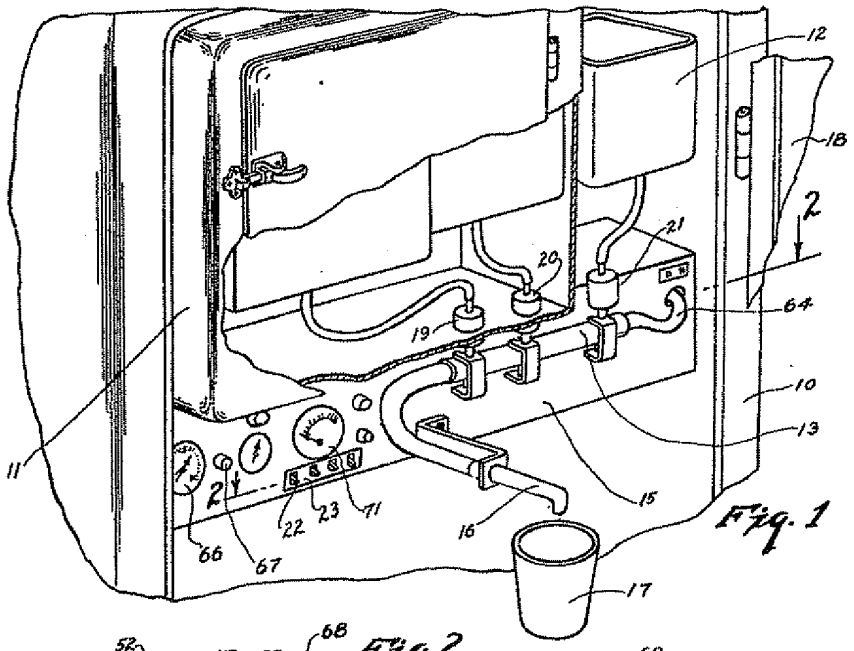

Fig. 1

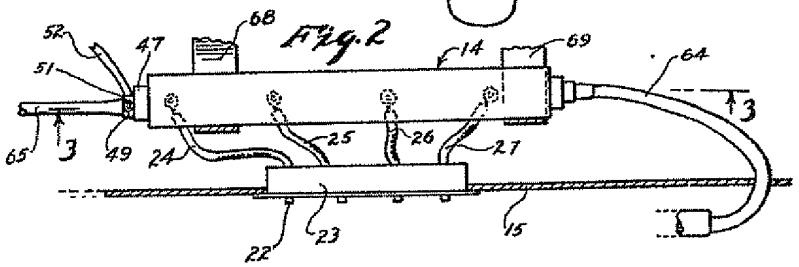

Fig. 2

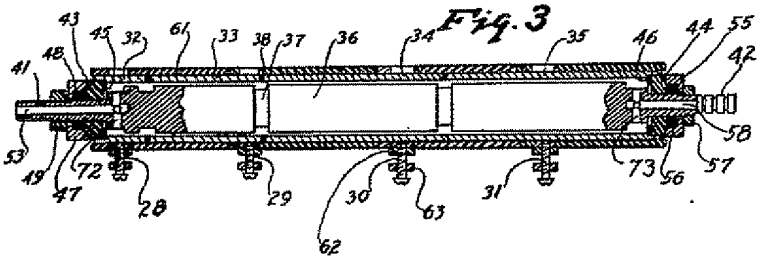

Fig. 3